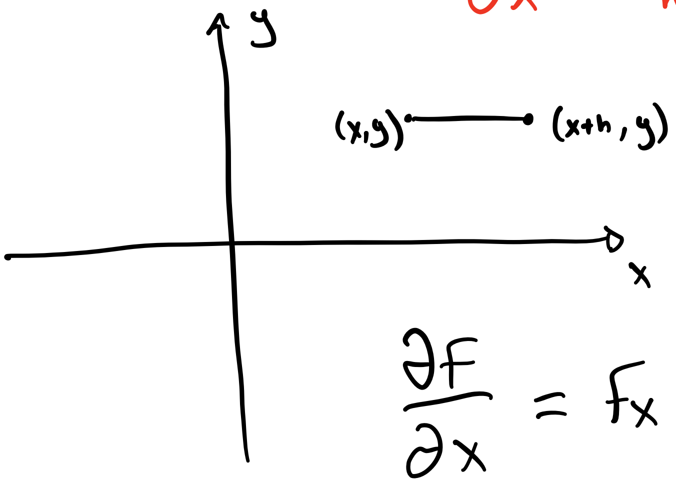
$\partial f / \partial x$ Partial derivative of f with respect to x

$$\frac{\partial f}{\partial x} = \lim_{h \to 0} \frac{f(x+h, y) - f(x,y)}{h}$$



$\frac{\partial f}{\partial x}(x_0, y_0)$ is the slope of the tangent line to the trace of the surface in a plane through (x_0, y_0) parallel to xz plane.

$$\frac{\partial f}{\partial x} = f_x$$

$$\frac{\partial f}{\partial y} = f_y$$

f_{xx} means $(f_x)_x$
- Take x-derivative and then take it again.

Mixed Partials → $f_{xy} = (f_x)_y = \frac{\partial}{\partial y}\left(\frac{\partial f}{\partial x}\right) = \frac{\partial^2 f}{\partial y \, dx}$

$$f(x,t) = e^{-2t} \cos(\pi x)$$

$$\frac{\partial f}{\partial x} = -\pi \cdot e^{-2t} \cdot \sin(\pi x)$$

$$\frac{\partial f}{\partial t} = -2e^{-2t} \cos(\pi x)$$

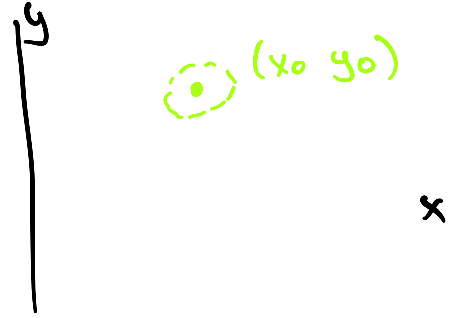
Think of other variable as a constant

$$\frac{\partial^2 f}{\partial x \partial t} = -2e^{-2t} \cos(\pi x) = -\pi \cdot 2e^{-2t} \sin(\pi x)$$

$$\frac{\partial^2 f}{\partial t \partial x} = e^{-2t} \cdot -\pi \sin(\pi x) = -2e^{-2t} \cdot -\pi \sin(\pi x)$$

Theorem (Clairaut's (Equivalence of mixed partials))

If f_{xy} and f_{yx} are continuous in a neighborhood of (x_0, y_0), then $f_{xy}(x_0, y_0) = f_{yx}(x_0, y_0)$



$$F(x,y,z) = xz - 4x^4 y^9 z^8$$

Find $\dfrac{\partial^3 F}{\partial x \partial y \partial z}$

$$\frac{\partial f}{\partial z} = x - 4x^4 y^9 8z^7$$

$$x - 32x^4 y^9 z^7$$

$$\frac{\partial f}{\partial y} = x - 32x^4 y^9 z^7$$

$$0 - 288x^4 y^8 z^7$$

$$\frac{\partial f}{\partial x} = -288(4)x^3 y^8 z^7$$

$$F(x,y) = x^{5y}$$

$$\frac{\partial f}{\partial x} = 5y\,x^{-1+5y}$$

$$\frac{\partial f}{\partial x} = x^{5y} \ln x\,(5)$$

$$\frac{d}{dt}(a^t)$$

$$a^t \ln a \cdot (t)'$$